

# LA-UR-21-31564

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**Title:** ASER Annual Site Environmental Report 2020 Summary

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**Intended for:** Report

**Issued:** 2022-01-04 (rev.1)



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# ASER

## Annual Site Environmental Report

### 2020 Summary

# Los Alamos National Laboratory Governing Policy For The Environment

- We are committed to act as stewards of our environment to achieve our mission in accordance with all applicable environmental requirements.
- We set continual improvement objectives and targets, measure and document our progress, and share our results with our workforce, sponsors, and public.
- We reduce our environmental risk through legacy cleanup, pollution prevention, and long-term sustainability programs.

## ANNUAL SITE ENVIRONMENTAL REPORT FOR 2020

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Original Prime Contract No. 89233218CNA000001



# Contents

<b>1</b>	<b>Breaking News</b>	<b>4</b>
<b>2</b>	<b>Compliance Summary</b>	
	2.1 Compliance at a Glance	6
	2.2 Year of the Permit	8
	2.3 Emerging Contaminants: Monitoring for PFAS	10
<b>3</b>	<b>Environmental Programs</b>	
	3.1 Refurbishing the Trails Program	12
	3.2 Manhattan Project National Historical Park Celebrates Five Years	14
	3.3 Pollution Prevention	16
<b>4</b>	<b>Air Quality and Meteorology</b>	
	4.1 Laboratory Data Supports Regional Climate Predictions	18
<b>5</b>	<b>Groundwater Protection Program</b>	
	5.1 Reducing Chromium Contamination of Groundwater	20
	5.2 Intellus Improvements and Groundwater Protection	22
<b>6</b>	<b>Watershed Quality</b>	
	6.1 Use Attainability Analysis for Upper Sandia Canyon	24
<b>7</b>	<b>Ecosystem Health</b>	
	7.1 Fish Monitoring in the Rio Grande and Abiquiu and Cochiti Reservoirs	26
	7.2 Bird Eggs and Nestling Results from Firing Sites	28
<b>8</b>	<b>Radiological Dose and Nonradiological Risk to the Public</b>	
	8.1 Monitoring Radiation Emissions	30
	8.2 Buried Waste along DP Road	32
	<b>Contributors</b>	<b>34</b>

# 1

## CHAPTER 1

# Breaking News

Mariah Gonzales and Beatrice Nisoli

### Vaccinations at the Laboratory

During the pandemic, Los Alamos National Laboratory was administering up to 2,300 Moderna and Pfizer vaccinations per week and had performed more than 30,139 COVID-19 tests by the end of October 2021. Also as of October 26, 98 percent of Laboratory employees have received at least one dose of a COVID-19 vaccine.

Per the vaccination mandate announced in August, all employees are fully vaccinated, with the exception of people who meet religious or medical exemptions.

Currently, the Laboratory also requires masks indoors. Employees who are fully vaccinated do not have to wear masks when working outdoors. Laboratory guests must provide proof of vaccination.

While the Laboratory is returning to 100 percent effectiveness, staff are continuing to closely monitor the situation. In the presence of multiple newly identified variants, the Laboratory will limit onsite personnel and in-person meetings as necessary to protect its workforce. An updated work location policy will give employees more work flexibility and optimize the use of technology and remote work.

With the Delta variant, the Laboratory has found only a minor increase in transmission throughout the state. Most vaccinated people are not getting as sick as the unvaccinated, and COVID-19 tracking has found that most people who are getting COVID-19 are not getting it from work. In fact, about 44 percent of COVID-19 cases occur because of travel, and 52 percent of COVID-19 cases are because of social gatherings.

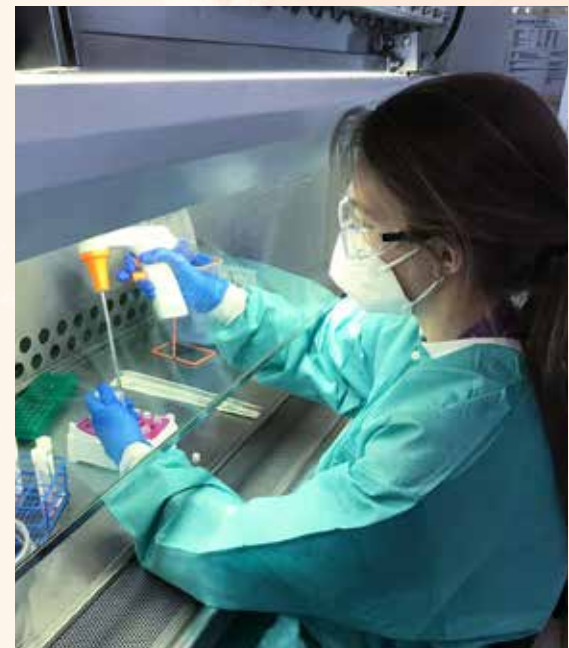
### Diagnostic Work at the Laboratory

On March 17, 2020, Laboratory leadership reached out to the Bioscience division with the goal of starting a COVID testing program on Laboratory property. The rapid spread of COVID-19 threatened the safety of Laboratory employees and the efficiency of operations. Due to the urgency of the project, the Bioscience division was able to convert the Biological Agent Testing Lab facility into a diagnostic facility in under six weeks.

The first diagnostic test for COVID-19 at the Laboratory facility was done on May 15, 2020, and Occupational Health staff have since collected an average of 150 samples a day. The samples are then sent to the diagnostic facility for results. Since the creation of the diagnostic facility, biological scientists have tested over 26,000 samples and helped identify asymptomatic carriers of COVID-19 to help reduce the spread of the virus across the Laboratory.



Lab vaccination drive-up.



Los Alamos technician in the COVID-19 Testing Lab.





## Flanged Tritium Waste Containers Venting

In 2020, and in accordance with the National Emission Standards for Emissions of Radionuclides Other than Radon, the Radioactive Air Emissions Management team had planned a project to vent four flanged tritium waste containers at Technical Area 54, the Lab's legacy waste management area. The Environmental Protection Agency received and approved the plan for the venting in June 2019, but several delays pushed back the venting date. Later plans were scheduled for April 2020, but the COVID-19 pandemic further delayed the project.

The venting is necessary to remove any pressure that may have built up in the containers to allow for safe handling and transportation. Tritium may have built up in the headspace of the containers, so venting releases the pressure. The excess gas then goes through an emissions control system before being released through a monitored exhaust stack. After the flanged tritium waste containers have been successfully released of pressure, the containers will be taken to the Laboratory's tritium facility for further processing and eventually shipped to an approved offsite disposal facility.

The Laboratory has held outreach meetings with the public, local pueblos, and local government entities in 2020 and 2021 to discuss the future of the project. The venting will not take place until all safety and formal readiness processes are complete.

## West Road Closures Are a Necessary Safety Initiative

In 2021, sorely needed upgrades were made to West Road, which connects the town of Los Alamos to Lab property via Jemez Road, prompted primarily by the desire to preserve public safety on Laboratory roads. This renovation involved temporary closures of some roads and limiting access to the reservoir—a popular Los Alamos hangout spot—until the road leading to it reopened in July 2021.

Initiatives to improve the road included a repaving job, widening the shoulder near the Camp May Road turnoff, and extending the guardrail lining the road. One large change in the area is the parking reconfiguration. Parking at or near the reservoir trail's entry is no longer permitted because of safety concerns; the parking spot was situated at the end of a hairpin turn that obscured driver visibility of any pedestrians running around the previously used parking space. The guardrail around the turn itself was extended and now blocks potential parking. However, ample parking is still available at the ice rink overflow for those wishing to access the reservoir trail.



Road construction in Los Alamos.

# Compliance at a Glance

Many state and federal laws or orders drive environmental compliance at the Laboratory.

Aaliya M. Casados



To be good stewards and neighbors, Los Alamos National Laboratory complies with state and federal laws that protect the health and welfare of workers, surrounding communities, and the public. Various regulations, permits, and limits help protect air quality, water quality, ecosystem health, and the overall environment in the present and for future generations.



## Radiation Protection

**DOE Order 458.1, Radiation Protection of the Public and the Environment:** The Department of Energy (DOE) regulates radiological dose limits for the public, for plants and wildlife, and for waste shipped offsite.

**Clean Air Act:** Regulates air emissions of radionuclides and limits national air pollution.

## Radiation Protection Highlights

During 2020, the estimated maximum radiological dose to a member of the public from Laboratory operations was less than 1 millirem, well below the annual DOE limit of 100 millirem. About 237.5 tons of metal exposed to ionizing radiation during Laboratory operations were shipped to appropriate facilities and recycled in 2020. Approximately 50 percent of that amount was from the Los Alamos Neutron Science Center's (LANSCE) accelerator operations.



## Waste Management

**DOE Order 435.1, Radioactive Waste Management:** Ensures that all DOE radioactive waste is managed in a manner that protects the health of workers and the public, and maintains environmental safety standards.

**Resource Conservation and Recovery Act (RCRA):** Creates the framework for the proper management of hazardous and non-hazardous solid waste. LANL's Hazardous Waste Facility Permit is issued under this law.

**2016 Compliance Order on Consent:** The Order on Consent between the New Mexico Environmental Department (NMED) and the Laboratory provides the time table and requirements for cleanup of contaminants released to the environment during past operations.

## Federal Facility Compliance Act:

Requires federal facilities that generate or store mixed radioactive and hazardous wastes to submit a Site Treatment Plan that includes a schedule for developing capacities and technologies to treat all the facility's waste.

## Waste Highlights

Triad reported only four instances and N3B reported only 17 instances of noncompliance with the Hazardous Waste Facility Permit to NMED. None of these instances of noncompliance threatened human health or the environment. All noncompliances were corrected within 24 hours except for one item, which was corrected within two days.

As part of the supplemental environmental projects associated with the settlement for the 2014 contamination event at the Waste Isolation Pilot Plant in Carlsbad, New Mexico, construction on the mid-Mortandad slope drain project was completed in February 2020 and certified to the NMED in March 2020.

During the fiscal year 2020, the mixed low-level waste covered under the Site Treatment Plan decreased due to offsite shipments of 57 cubic meters (74 cubic yards). The mixed transuranic waste covered under the Site Treatment Plan also decreased as 172 cubic meters (226 cubic yards) were shipped to the Waste Isolation Pilot Plant.





## Air Quality

**Clean Air Act/ Title V Operating Permit:** Regulates air emissions from Laboratory operations such as emissions from the power plant, asphalt batch plant, and permanent generators.

**New Mexico Air Quality Control Act:** Regulates construction or modification of air emission sources.

## Air Quality Highlights

The Laboratory had no emissions in excess of permit limits occurring from any of the permitted sources, and emissions, in fact, were between 4 and 20 percent of the permit limits.

In an effort to reduce sources of ozone-depleting chemicals often found in refrigerants and solvents, the Laboratory sent 1,797 pounds of refrigerant offsite for disposal in 2020. Of that amount, 627 pounds were hydrochlorofluorocarbons and 1,170 pounds were hydrofluorocarbons.



## Water Quality

**Clean Water Act:** Aims to restore and maintain the chemical, physical, and biological integrity of the nation's waters.

**New Mexico Water Quality Act:** Adopts standards for surface waters of the state by defining designated surface water uses, sets water quality criteria to protect those uses, and provides an antidegradation policy.

**Energy Independence and Security Act:** Section 438 of the Energy Independence and Security Act of 2007 establishes storm water runoff requirements for federal development and redevelopment projects through infiltration, evapotranspiration, and harvest and reuse.

## Water Quality Highlights

For the sites regulated for storm water run-off under the Individual Permit, the Laboratory

- Completed 446 inspections of storm water controls at the 250 site-monitoring areas,
- Completed 508 sampling equipment inspections,
- Conducted storm water monitoring at 127 site-monitoring areas, and
- Installed 16 additional control measures at 10 site-monitoring areas.

Held two public meetings as required by the Individual Permit.



## Natural and Cultural Resources

**National Historic Preservation Act:** Requires federal agencies to evaluate and mitigate any potential impacts that projects may have on eligible archaeological sites and historic buildings.

**Endangered Species Act:** Ensures that federal agencies protect federally listed threatened or endangered species and their habitats from onsite operations.

**Migratory Bird Treaty Act:** Makes it unlawful "by any means or manner to pursue, hunt, take, capture or kill" any migratory birds except as permitted by U.S. Fish and Wildlife Service.

**Floodplain, Wetland, and Invasive Species Executive Orders:** The Laboratory complies with Executive Order 11988, Floodplain Management, and Executive Order 11990, Protection of Wetlands, by preparing floodplain and wetland assessments for projects in floodplains or near wetlands.

**National Environmental Policy Act (NEPA):** Requires federal agencies to consider and mitigate potential impacts for proposed projects or undertakings that could affect the environment.

## Natural and Cultural Resources Highlights

In 2020, environmental staff reviewed approximately 900 proposed projects.

NEPA staff prepared a sixth supplement analysis to the 2008 Site-Wide Environmental Impact Statement for producing no fewer than 30 pits per year at the Laboratory.

Cultural resources staff completed a legacy report on the excavation and updated eligibility for a homestead site and submitted it to the State Historic Preservation Office.

In 2020, Laboratory staff prepared three biological assessments to analyze the impacts to listed species, which received concurrence from the U.S. Fish and Wildlife Service.

Biologists captured and banded 729 birds during the breeding season in Sandia Canyon and during fall migration in Pajarito Canyon as part of monitoring migratory birds on LANL property.



## Other Environmental Protections

**Toxic Substances Control Act:** Regulates and monitors new and existing chemicals in the United States.

**Federal Insecticide, Fungicide, and Rodenticide Act:** Regulates the use, sale, and production of pesticides by requiring all users to register with the U.S. Environmental Protection Agency to protect both public health and the environment.

**New Mexico Pesticide Control Act:** Regulates the New Mexico Department of Agriculture authority over pesticides and pesticide applicators in the state, which includes definitions, requirements, authorities, fees, grounds for license denials, and suspensions or revocations.

**Emergency Planning and Community Right-to-Know Act:** Requires emergency plans for hazardous substances and for the public to be made aware.

# Year of the Permit

Compliance with environmental laws and orders is integral to Los Alamos National Laboratory's environmental stewardship.

Aaliya M. Casados



In 2020, five of the Laboratory's environmental permits were up for renewal. The process for renewal is unique to each permit due to the state and/or federal agency providing oversight, which is explained in the Annual Site Environmental Report. Three of the permits in particular—the Resource Conservation and Recovery Act (RCRA), the Title V Operating Permit, and the Individual Permit—play a large role in the Laboratory's environmental compliance of waste, air, and water, respectively. The processes for renewing these permits to keep the Laboratory fully operational and compliant is long and arduous and requires extensive planning.

## Resource Conservation and Recovery Act (RCRA)

RCRA regulates hazardous waste from the moment it's created through its disposal. In accordance with RCRA, facilities that treat, store, or dispose of hazardous waste must operate under a permit. In 2020, the Department of Energy (DOE) field offices, Triad, and N3B applied to renew their joint Los Alamos National Laboratory Hazardous Waste Facility Permit, which must be renewed every ten years.

The application for RCRA is over 2,200 pages long, with 27 units, or areas, permitted and three interim pending units in addition to the renewed permit. Approximately 1,000 pages are dedicated to the proposal of permitting the three interim status treatment units,

and provide information on how operations at those three facilities protect the environment. These facilities include one open-burning unit and two open-detonation units. The Laboratory operates these units ensuring they comply with New Mexico regulations, but they have never permitted by the New Mexico Environment Department (NMED). Unit-specific requirements are added by NMED during the permitting process that may add requirements to address public concern and contribute to more transparent operations. LANL has requested that NMED permit these units.

## How Waste Is Disposed



1. IDENTIFY AND DOCUMENT WASTE



2. LOAD AND SEAL



3. SURVEYS AND SAFEGUARDS



4. STAGING AND MOVING



5. FINAL APPROVAL AND TRACKING



## Title V Operating Permit

The Laboratory complies with New Mexico's Clean Air Act Title V Operating Permit, which requires air emissions of regulated pollutants remain under permit limits, and aims to protect the public by limiting air emissions from industrial sources. Every five years, the Title V Operating Permit is renewed, a public hearing is scheduled, and public comments are accepted. In 2020, emissions from the Laboratory were significantly below permit limits. For example, nitrogen oxide emissions were approximately 20 percent of the permit limit, carbon monoxide emissions were 12 percent of the permit limit, and particulate matter emissions were 4 percent of the permit limit.

Historically, emissions have stayed well below permit limits, which is an exceptional accomplishment for the Air Quality and Compliance Program. Monitoring and record keeping is done monthly, semiannually, and annually to keep track of Laboratory air emissions. In the hypothetical event that these nonradiological air emissions approach permit limits, projects would be paused for review, and it could take up to one year if a modification to the permit is needed.

"The Laboratory's Title V Operating permit compliance program is a mature and robust program," says Meteorology and Air Quality Team Leader Marjorie Stockton.

**"Annual emissions are well below all permit limits, and internal procedures and processes are in place to ensure all monitoring, reporting, and record keeping requirements are met."**

## Individual Permit

Laboratory staff started the renewal process for the Individual Permit in 2019 and conducted a public hearing and comment period in fall 2020. Although NMED has issued its certification, the final permit has not yet been issued by the U.S. Environmental Protection Agency.

The Individual Permit authorizes discharges of storm water from certain Solid Waste Management Units and Areas of Concern, collectively referred to as sites, at the Laboratory. The Individual Permit lists 405 sites that must be managed to remain in compliance, all with the goal of preventing storm water runoff from transporting pollutants of concern to surface waters.

The process of complying with the Individual Permit can be broken down into five steps:

1. installation and maintenance of control measures
2. storm water sampling to determine effectiveness of control measures
3. additional corrective actions if a target action level exceeds permit limits
4. reporting results of fieldwork and monitoring to the Environmental Protection Agency and NMED, and
5. certification of corrective action completed or requested for alternative compliance to the Environmental Protection Agency.





# 2

## Emerging Contaminants: Monitoring for PFAS at Los Alamos National Laboratory

PFAS has not been widely used at the Laboratory historically and is limited primarily to aqueous film-forming foam used nationally for fire suppression.

Abdul Khweis

Per- and polyfluoroalkyl substances, also known as PFAS, are man-made chemicals developed about 80 years ago. These chemicals can be found in many manufactured items—from food packaging and cookware to firefighting foams. PFAS can beneficially repel oil, stains, grease, and water. But new data suggests that PFAS may also result in negative health effects such as cancer and a lowered immune response. Recently, Los Alamos National Laboratory discovered PFAS chemicals in two fire suppression systems.

In 2018, the Laboratory became aware of PFAS as emerging contaminants and took immediate action to investigate PFAS onsite. Although there are more than 4,700 types of PFAS compounds, the most effective commercial analytical laboratories can detect fewer than 100. Neither the U.S. Environmental Protection Agency nor the State of New Mexico regulate PFAS compounds; however, the Environmental Protection Agency issued a health advisory of 70 parts per trillion total for PFAS concentrations in drinking water. Although no laws required the Laboratory to test for PFAS in 2020, LANL did so because of its responsibility to be a good steward of the environment.

As part of the effort to identify PFAS, the Laboratory's Pollution Prevention Program, which monitors the field of emerging contaminants, researched past and present uses of PFAS. The program searched various records and databases, including the Laboratory's institutional chemical database, known as ChemDB, and WCATS, the waste tracking database. This led to the discovery of PFAS in the two fire suppression systems containing aqueous film forming foam. While PFAS has been detected, more information is needed in general to determine the impact of these chemicals.

**LANL is not a major PFAS contributor.**

### Ways PFAS Contaminants Enter the Body



INHALATION



CONSUMPTION



PHYSICAL CONTACT

Contributors tend to be manufacturing facilities, Department of Defense sites, or sanitary wastewater treatment facilities.

“As a large institution that must be a responsible neighbor to surrounding communities and a good steward of the environment, it is critical that the Laboratory act early when we are made aware of any emerging contaminant,” says Kassidy Boorman, a program lead in the Pollution Prevention Program. “We are proud that we started looking into any possible presence of PFAS on the site as soon as we became aware of it.”

Another program that helps to better understand PFAS impact at the Laboratory is the Soil, Foodstuffs and Biota program. This program determines if Laboratory operations are impacting human health via the food chain. In 2020, their PFAS efforts included sampling roadkill from onsite and background locations; soil, sediment, and vegetation collected onsite; and small mammals collected from Los Alamos and Pajarito canyons. The program detected PFAS at concentrations below ecological screening levels in the soils and sediments around the Dual-Axis Radiographic Hydrodynamic Testing Facility.

“Overall, the frequency of PFAS detection is very low at the Laboratory,” says Shannon Gaukler, program lead for the Soil, Foodstuffs and Biota program.

**“While some PFAS chemicals are detected in the samples we monitor, observations at the Laboratory are comparable to levels observed in samples collected from elsewhere around the globe at non-polluted sites, suggesting that the Laboratory is not impacting PFAS levels in the environment.”**

As PFAS is an emerging concern, and the effects on human health and the environment are still not fully understood, the Laboratory will continue to monitor even the small amounts of PFAS produced as a result of its operations.

## Products that contain PFAS



CLEANING PRODUCTS



NON-STICK COOKWARE



DENTAL FLOSS



PAINTS, SEALANTS, AND VARNISHES



EYE MAKEUP



PESTICIDES



FAST FOOD PACKAGING/WRAPPERS



PIZZA BOXES



FIREFIGHTING FOAMS



SHAMPOO



MICROWAVE POPCORN BAGS



STAIN RESISTANT PRODUCTS



NAILPOLISH



WATER RESISTANT CLOTHING



# 3

## CHAPTER 3.1 ENVIRONMENTAL PROGRAMS

# Refurbishing the Trails Program

From redesigning all trail kiosks to educating the public extensively on unexploded ordnance, the Laboratory's Trails Working Group underwent renewing changes and amplified its safety initiatives.

Beatrice Nisoli

In 2020, the Laboratory's constantly evolving Trails Management Program was refurbished, prompting a new design for trailhead kiosks, a more polished mobile application, and an educational initiative regarding unexploded ordnance.



Mountain biking above the Rio Grande.



A newly created and updated kiosk poster is available at all Los Alamos trailheads. The changes reflect more accurate and relevant safety information, a heightened focus on unexploded ordnances, and an overall more legible formatting.

The LANL Trails Management Program, or Trails Program, was established in December 2003 following the publication of the Final Environmental Assessment for the Proposed Los Alamos National Laboratory Trails Management Program. A standing Trails Working Group made up of LANL and other agencies and stakeholders was formed to help carry out this program. The Trails Working Group includes representatives from local trail users, Los Alamos County,

the Forest Service, the Park Service, the Laboratory, the National Nuclear Security Administration's Los Alamos Field Office, and other stakeholders. Since its conception 18 years ago, the group has met bimonthly to discuss any trail related issues that may affect public safety or overall enjoyment of Los Alamos's recreational benefits.

Recreational trail use remains a highly valued benefit of working and living in



Los Alamos County. The Trails Program oversees trails located on U.S. Department of Energy (DOE) property throughout the county and ensures their use does not interfere with the security of LANL operations and protection of environmental resources.

The program often faces the daunting task of adapting trail use in accordance with the changing environmental and cultural conditions in Los Alamos while also endeavoring to respect the wishes of local Pueblos to prevent unauthorized public access to adjacent lands identified as religiously and culturally sensitive to Native American communities.

In other words, the Trails Program's initiatives stem from a desire to keep DOE-owned lands open to the public for nonmotorized recreational purposes, so long as the treatment and stewardship of the lands themselves remain in compliance with federal laws and LANL operational constraints.

After observing the rundown state of the trails' previous kiosks (broken plexiglass, weak wooden posts, and chipped paint were but a few issues), new kiosks were purchased, which also required more optimally sized posters that better fit the new kiosk dimensions. The Trails Program took advantage of this development as an opportunity to address any shortcomings in the existing kiosk posters, planning to refurbish them into more aesthetically appealing and relevant versions for the public. The changes included an entirely new design format and updated safety initiatives while retaining the fundamental elements of previous posters, such as a comprehensive map of the respective trails and important phone numbers to call with questions or concerns.

"The network of trails within Los Alamos is one of the greatest benefits of living here and having trails accessible at an

## GATE 11:

### POTRILLO CANYON LOOP TRAIL

Los Alamos National Laboratory Trails Management Program

#### RULES

Public access to LANL trails depends on good stewardship. Protect this sensitive area by following these rules:

- Open doors to dusk, stay trail closures
- Control and clean after your pet
- Do not feed wildlife
- Pack in and pack out, leave no trace
- No digging or trail building
- Do not collect, disturb, or remove natural or archaeological resources

#### HAZARDS

Use of this trail is at your own risk. Please be aware of hazards:

- BEAR HABITAT
- MOUNTAIN LION HABITAT
- FLASH FLOOD

#### UNEXPLODED ORDNANCE (UXO) POSSIBLE

Area formerly used by military. FOLLOW THE THREE R'S OF UXO SAFETY:

- RECOGNIZE:** The danger that a souvenir munition poses to yourself, family, and neighbors.
- RETREAT:** Do not disturb, touch, or move it.
- REPORT:** Call 667-2400 or 911.

### UNEXPLODED ORDNANCE (UXO) POSSIBLE

Area formerly used by military  
**FOLLOW THE THREE R'S OF UXO SAFETY**

- RECOGNIZE:** The danger that a souvenir munition poses to yourself, family, and neighbors.
- RETREAT:** Do not disturb, touch, or move it.
- REPORT:** Call 667-2400 or 911.



These images detail the variety in shape, size, color, and type of unexploded ordnance that can be found off of Los Alamos trails. For reference, "Three R's of UXO Safety" details what must be done if an unexploded ordnance is encountered. This graphic is included on all Los Alamos trailhead kiosk posters.

institution like LANL is a unique bonus," says Karen Musgrave, one of the Trails Program leads. "This past year we have focused on making trails and safety information more accessible and up to date so that people can take advantage of this resource."

In tandem with the updated kiosks, the Trails Program focused its efforts on educating the public on unexploded ordnance because they have historically been found (though rarely) in Technical Areas 70 and 71, which are accessed from NM Highway 4 and Pajarito Acres. An unexploded ordnance is any sort of military ammunition or explosive that has failed to function as intended and can cause damage if handled, despite its dormant nature. During World War II, the United States Army—stationed in Los Alamos for the Manhattan Project—used the remote areas surrounding the Laboratory as artillery training grounds.

Although the chances of finding unexploded ordnance are low because they have long since been cleared from actual trail pathways, the Trails Program

aimed to educate the public on the dormant explosives to proactively minimize any potential safety hazards. This initiative included adding more information about unexploded ordnance on kiosk posters, the Trails app, and website. Among other contextual information, the kiosk posters and website advise following the "3 Rs" of encountering an unexploded ordnance: "recognize" its appearance, "retreat" from the object immediately without disturbing it, and "report" its location by calling (505) 667-2400.

"The trails in Los Alamos have many unique qualities, such as the flora and fauna and the varied history of the area," Musgrave says. "This complex history also creates unique hazards. We have worked to improve our educational awareness of the history of unexploded ordnances and the risks associated with them in hopes of providing meaningful safety information for trail users."

# 3

## CHAPTER 3.2

# Manhattan Project National Historical Park Celebrates Five Years

The Laboratory and Park Service celebrated with improvements on and innovations to Los Alamos historic sites.

Victoria M. Lovato

The Manhattan Project National Historical Park was formally established in 2015 when Congress passed the National Defense Act with the goal of preserving World War II sites associated with the top secret Manhattan Project and the creation of the atomic bomb. The Manhattan Project National Historical Park preserves sites in Hanford, Washington; Oak Ridge, Tennessee; and Los Alamos, New Mexico. In 2020, the park celebrated its fifth-year anniversary during an unprecedented year that brought many changes along with opportunities for growth and development.



A Manhattan Project National Historic Park tour.

A major change for 2020 was the inability to conduct annual onsite public tours because of COVID-19 regulations and concerns for the safety of visitors and staff. In place of hosting onsite tours, the Laboratory collaborated with the National Park Service and the staff at Hanford and Oak Ridge to produce virtual walk-through tours of the Manhattan Project National Historical Park buildings, including Gun Site and V-Site, which are not open to the public. These virtual tours will not only provide an alternative to onsite tours during the COVID-19 pandemic, but they also will allow future guests the opportunity to visit the park without being physically present and in areas of active Laboratory operations.

While working under the constraints of COVID regulations, archaeologists also recorded a cavate complex in Technical Area 18. Cavates are man-made masonry rooms carved into cliff faces and are unique to the Pajarito Plateau. By the end of the year, the team was able to record 60 of the approximate 160 cavates within the site. In addition to the cavates, the team recorded many interesting features including a historic graffiti site and a pre-Hispanic ancestral trail.

The Cultural Resources team also made significant progress in the preservation of Park buildings. Many of the structures were built for their immediate function and not with longevity in mind, which has resulted in their deterioration.





Archaeologists recording cave complex.



Stem wall at TA-16 V-Site before repairs.



Stem wall at TA-16 V-site after repairs.

“Concrete has proven to be especially susceptible to the dozens of freeze-thaw cycles that often take place on a winter day in Los Alamos,” says Jeremy Brunette, a cultural resources specialist.

One of these projects was the Concrete Bowl, a 200-foot-long bowl constructed in 1944 to support plutonium recovery methods in the event that the Trinity Test failed. However, scientists soon realized that this recovery method would not be feasible on a full-scale nuclear test, and the Concrete Bowl was repurposed and then abandoned following the Manhattan Project.

While it remains a testament of the scientific innovation of the Manhattan Project, the Concrete Bowl required maintenance and the removal of a tree from its center. Vital Consulting Group was contracted to remove the tree, and to prevent further growth or damage to the structure. The group used a chemical herbicide on the tree stump, then removed soil and weeds from the concrete joints and graded the soil away from the bowl to lessen the accumulation of rainwater at its center.

Two other Manhattan Project-era sites that required renovation were Gun Site and V-Site. Both of these supported early nuclear bomb research but had fallen into disrepair. Gun Site was used to provide researchers shelter while performing “gun-assembly” tests during the development of Little Boy, one of two nuclear devices later used in World War II. At Gun Site, a failing concrete cap on the parapet was removed. At V-Site, repairs were made to a concrete wall damaged by the 2000 Cerro Grande forest fire, which destroyed several buildings at V-Site.

In the next year, the Cultural Resources Team also plans to administer multiple repairs to the Slotin Building, the site where physicist Louis Slotin was fatally exposed to radiation while performing an experiment in 1946. When Department of Energy funding is acquired, the team plans to replace asbestos shingles in the roof, build an ADA/ABA accessible ramp, reconstruct a door, and restore the interior to its original configuration.



Concrete bowl before tree removal and repair.



Parapet wall at gun site before concrete repairs.



Parapet wall at gun site after concrete repairs.



Construction crew making repairs.



# 3

## CHAPTER 3.3

# Pollution Prevention at the Laboratory

**In 2020, the Pollution Prevention Program funded projects involving two techniques that would eliminate pollution created from explosive processes at their source.**

Caitlyn Cruz

The Pollution Prevention Program at Los Alamos National Laboratory works to reduce radioactive waste, fund projects that eliminate or reduce the use of hazardous chemicals, and research and identify emerging contaminants. In 2020, the program continued to improve the management of sheds and transportable storage buildings, along with coordinating over 20 cleanup and metal recycling projects across the Laboratory. The program also helped clean up legacy environmental monitoring stations, such as air and water quality stations.

Several offices work under the Pollution Prevention Program, all with the goal of reducing the Laboratory's impact on the environment.

In 2020, a Chemical Management team was established as a spinoff of the Pollution Prevention Program to continue the reduction of hazardous chemicals and enforce proper chemical inventory. The program also introduced two new processes to reduce waste from explosive processes at their source: planetary ball milling and resonant acoustic mixing.

The Site Cleanup and Workplace Stewardship program, established in 2013, collaborates with Pollution Prevention to assist organizations with the disposal of unneeded materials and equipment to prevent the abandonment of such items after projects are completed. Staff work to develop plans for managing abandoned materials and cleaning indoor and outdoor spaces throughout the Laboratory.

Another key part of the Pollution Prevention Program is the Sustainability Office, which focuses on reducing energy and greenhouse gas emissions.



Several inoperable monitoring stations were removed from TA-54 and sent to metal recycling; EPC removed all “spare parts” for use with remaining monitoring stations.

In 2020, the Laboratory reached a 27.7 percent reduction of greenhouse gas emissions compared to 2008.

While energy use at the Laboratory is expected to increase over the next ten years as a result of high-performance projects, the Sustainability Office plans to further reduce emissions through the Steam Plant Replacement project, which will add more energy-efficient generators.

## Optimizing Management

Chemical Management, previously staffed and funded by Pollution Prevention, strives to reduce chemical purchases, recommend safer alternatives, and monitor chemical inventory. In 2021, the program will help prevent unnecessary chemicals from coming onsite and help utilize safe chemicals already in inventory.

The Pollution Prevention Program has also introduced specific technique alternatives that will help reduce hazardous waste, especially in pollution in the manufacturing of high explosives, at their source.



An abandoned faraday cage was left in the parking lot of TA-3 SM40. Site Cleanup sent what it could to metal recycle and trashed the remainder.



An abandoned welding machine at TA-3 SM40 was still operable and was able to go through the Salvage process.

## Reducing Hazardous Acids

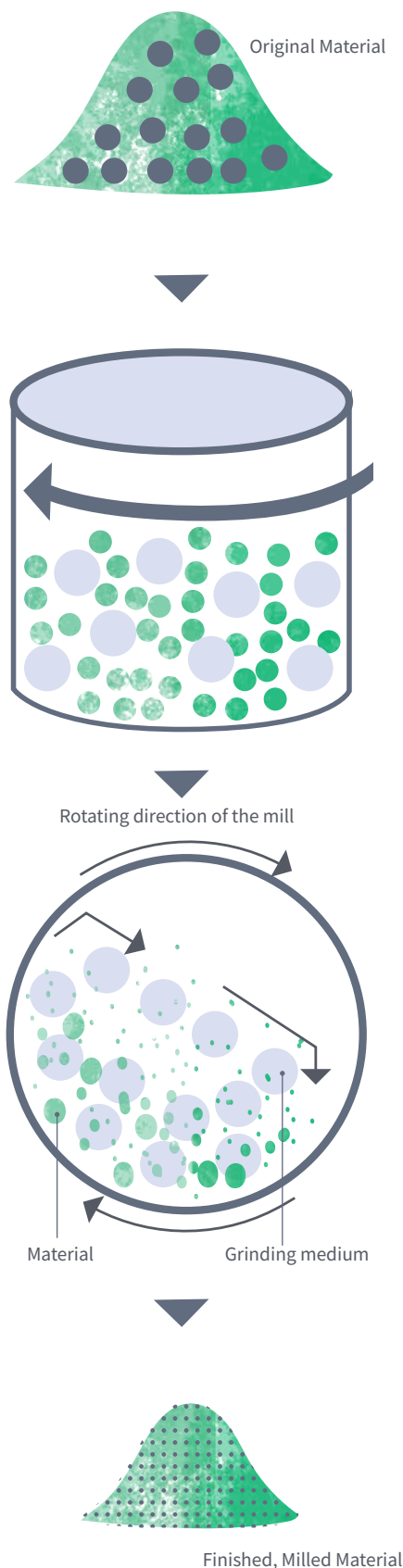
Along with the previously mentioned gains, the program made several advancements to reduce waste from the explosive manufacturing process, including planetary ball milling and resonant acoustic mixing.

Traditional techniques use concentrated acids to manufacture high explosives. Planetary ball milling, however, is an emerging innovation. This environmentally friendly and cost-effective technique grinds powders into extremely fine particles, allowing for high explosives to deposit more energy in a more efficient manner. It is also believed that this technique will reduce disposal and purchase costs while being safer for workers because they are not exposed to hazardous chemicals.

Likewise, resonant acoustic mixing is a process that helps cut down on waste and improves worker safety. The traditional wet slurry method, a process that generates hazardous solvents and water, leading to expensive waste management, was previously used to help formulate explosives at the Laboratory.

But the resonant acoustic mixing method uses resonance and the effects of sound energy to facilitate mixing without the use of impellers inside a mixing vessel. Once online, this method will help the Laboratory reduce disposal and purchase costs associated with the concentrated acids. Also, because resonant acoustic mixing is a sealed system, workers will be exposed to fewer hazardous chemicals.

## Planetary Ball Milling Process





# 4

## Laboratory Data Supports Regional Climate Predictions

**Meteorologists at the Laboratory have found increasingly warmer days, which could lead to more wildfires and harsher droughts—data that is consistent with regional predictions about climate change.**

**Mariah Gonzales**

Meteorological data has been collected in Los Alamos for more than 100 years. Early farmers were the first to take note of weather patterns, now studied by Laboratory scientists, who know the importance of tracking weather patterns for future understanding of the climate. Currently, Laboratory meteorologists working in the Meteorology and Air Quality Group collect and analyze data on local temperatures, wind speeds, precipitation, solar radiation, and humidity levels.

**When compared with historical meteorological data, data from recent decades show that Los Alamos has seen a rise in temperatures and wind speeds due to climate change.**

These findings could lead to greater chances of wildfires in the area, as well as increased cooling costs for facilities.

To collect meteorological data, the Lab installed five meteorological towers across its property, and, in 2020, added three more towers. These weather sensing instruments are set at multiple height levels to collect data, which improves atmospheric dispersion modeling. Samples are collected every

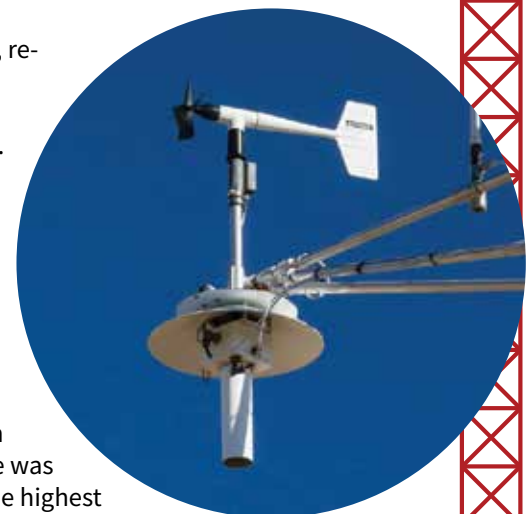
three seconds and readings are averaged every 15 minutes. These data have been analyzed daily and sent to the National Weather Service for more than 50 years.

Using data reaching back to 1910, researchers at the Laboratory have noticed a gradual increase in temperatures across the decades. In fact, five of the hottest summers on record have occurred since 2002.

“On July 11, 2020, the daily average temperature was recorded at 97.5°F,” says Lab meteorologist David Bruggeman. “This is higher than in 2016, when the highest recorded temperature was 97.5°F. These temperatures are the highest measured since the previous highest recording in 1910.”

This temperature increase is also reflected in the average annual temperature at the Laboratory. From 1960 to 2000, there was no notable increase from the annual average temperature of 48°F. But from 2001 to 2010, the average annual temperature increased to above 49°F. Between 2011 and 2020, the average annual temperature has increased to above 50°F, with 2020’s annual average temperature reaching 51.4°F.

Higher temperatures are not the only result of climate change. Over the past 25 years, one meteorological tower (located in Technical Area 6) has shown a 20 percent increase in wind speed. From year to year, the monthly average wind speed during the spring months has shown a one-meter-per-second increase. Meteorologists attribute this to the loss of vegetation caused by wildfires, drought, and bark beetle infestations that kill trees, because vegetation tends to slow wind as it moves across the ground’s surface. Higher wind speed can impact the



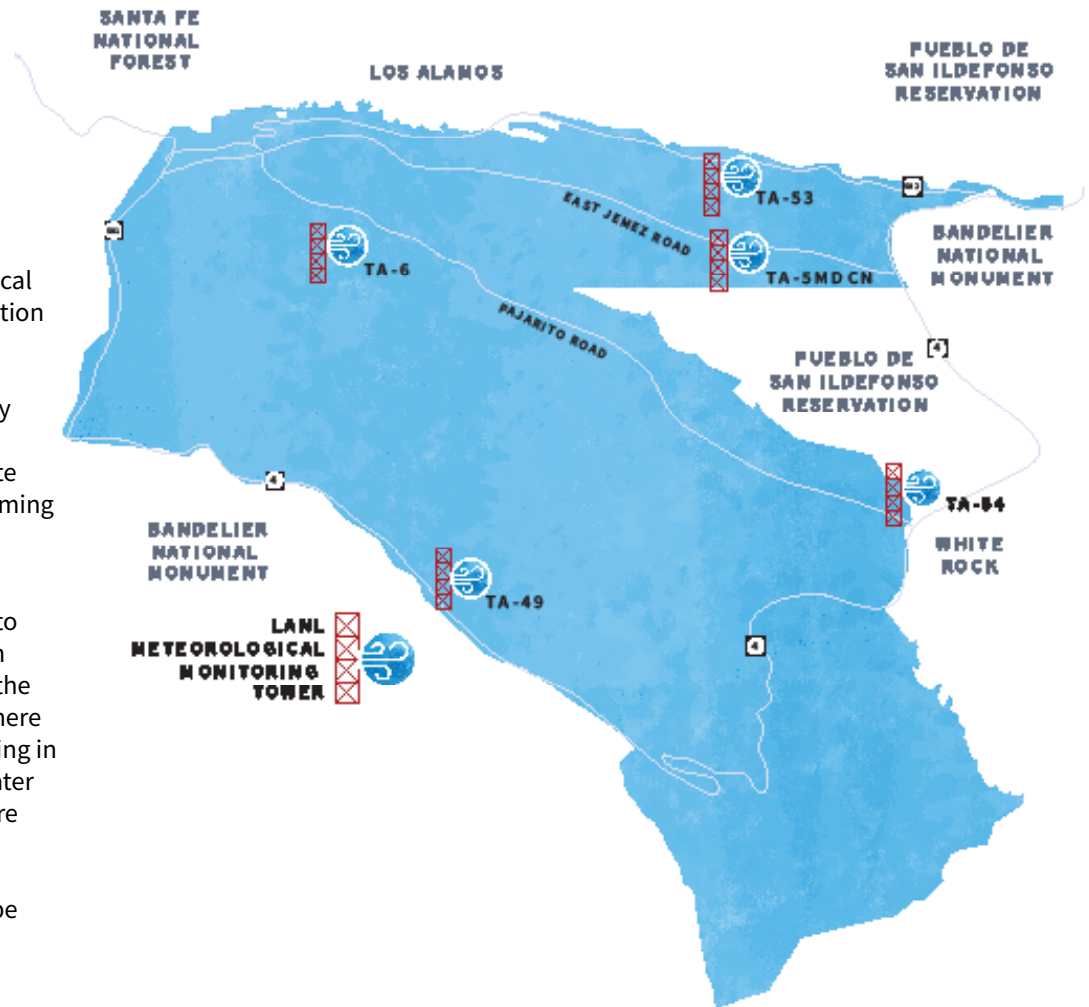
Air Monitor



intensity of wildfires, creating a cyclical effect that can lead to further vegetation loss and thus higher wind speeds.

This meteorological data gathered by the Laboratory is consistent with predictions from the National Climate Assessment reports that show a warming Southwest region.

With warming temperatures, the Laboratory can expect energy costs to rise as warmer average days result in higher cooling costs for facilities. At the same time as higher cooling costs, there would be lower heating costs, resulting in an unknown net difference. The greater Los Alamos area can also expect more frequent droughts and wildfires. All of this means that, in the future, regular Laboratory operations may be affected as wind speeds and wildfire threats potentially delay projects.



Heating and cooling degree days are used to estimate the annual power needed to supply heat or air conditioning to Laboratory buildings. Heating degree days occur when the daily average temperature is below 65°F, requiring heat to be turned on. Cooling degree days occur above 65°F, which requires artificial cooling. While the average number of heating degree days has declined since 1990, the number of cooling degree days have increased steadily, making this a new normal.

Above: Stands of tree mortality. Below: Bark beetle.

# 5

## Reducing Chromium Contamination of Groundwater

**Chromium contamination, a continued concern at Los Alamos National Laboratory, is being mitigated by the Chromium Contamination Interim Plan.**

Jean Janvier



Groundwater sampling at well R-50.

Los Alamos National Laboratory has made many efforts to track the movement of contaminants in groundwater, surface water, and soil. At the moment, there is a chromium plume in groundwater at about 1,000 feet beneath Sandia and Mortandad canyons. The plume, which is about a mile long and half a mile wide and generally less than 100 feet thick, has chromium levels that exceed 50 micrograms per liter, the groundwater standard set by the state of New Mexico.

Chromium can enter the environment in a variety of ways. Sandia Canyon is an effluent-dependent water body, and it receives its effluent from discharges from cooling towers for computing facilities, the steam plant, and the Sanitary Wastewater Treatment Plant. The contamination in this plume originated from potassium dichromate used from 1956 to 1972 as a corrosion inhibitor in the cooling system for an onsite power plant and historically was discharged into the canyon.

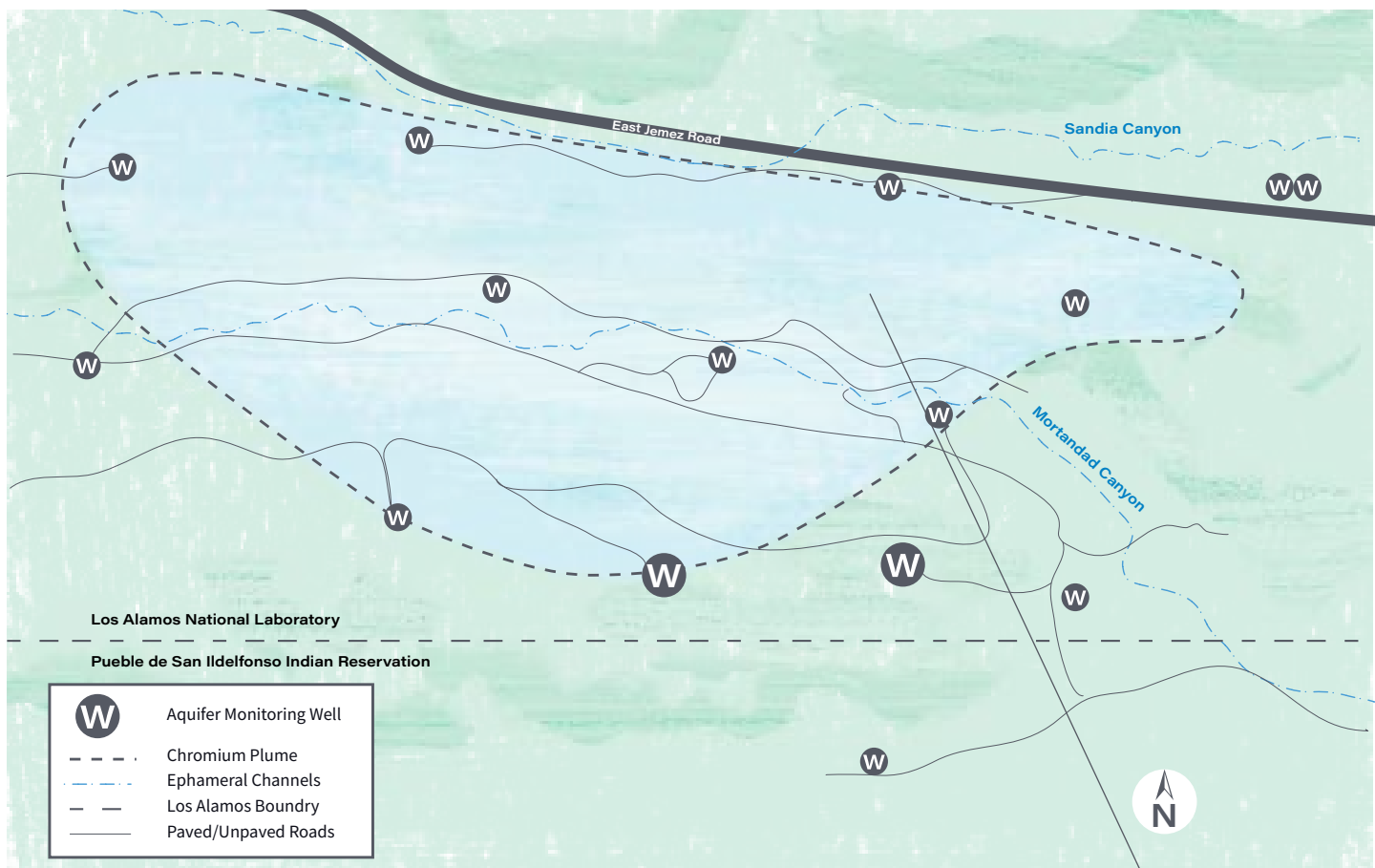
To mitigate chromium contamination, the Laboratory established the Chromium Interim Measure in late 2016. The objective is to stabilize the part of the plume that has a chromium concentration greater than 50 micrograms per liter within Laboratory property and prevent it from migrating. This is done by extracting contaminated groundwater using up to five extraction wells, then

pumping that water to an ion exchange treatment system. Lastly, this treated water is injected back into the groundwater, down gradient of the contaminated area. The Interim Measure is mainly focused along the boundary between the Laboratory and the Pueblo de San Ildefonso.

A series of aquifer wells are used to monitor the Interim Measure's effectiveness. Based on the data collected from monitoring wells R44 and R50 between December 2015 and December 2020, the level of chromium contamination is dropping along the boundary with Pueblo de San Ildefonso, the site where the Interim Measure has been operating the longest. These levels are currently below the New Mexico Groundwater Standards for chromium.

**In fact, according to Danny Katzman, who leads the groundwater remediation effort for N3B, “We’ve met our initial objective of controlling plume migration along the Laboratory’s boundary with the Pueblo de San Ildefonso and plan to build on that success in the near future.”**

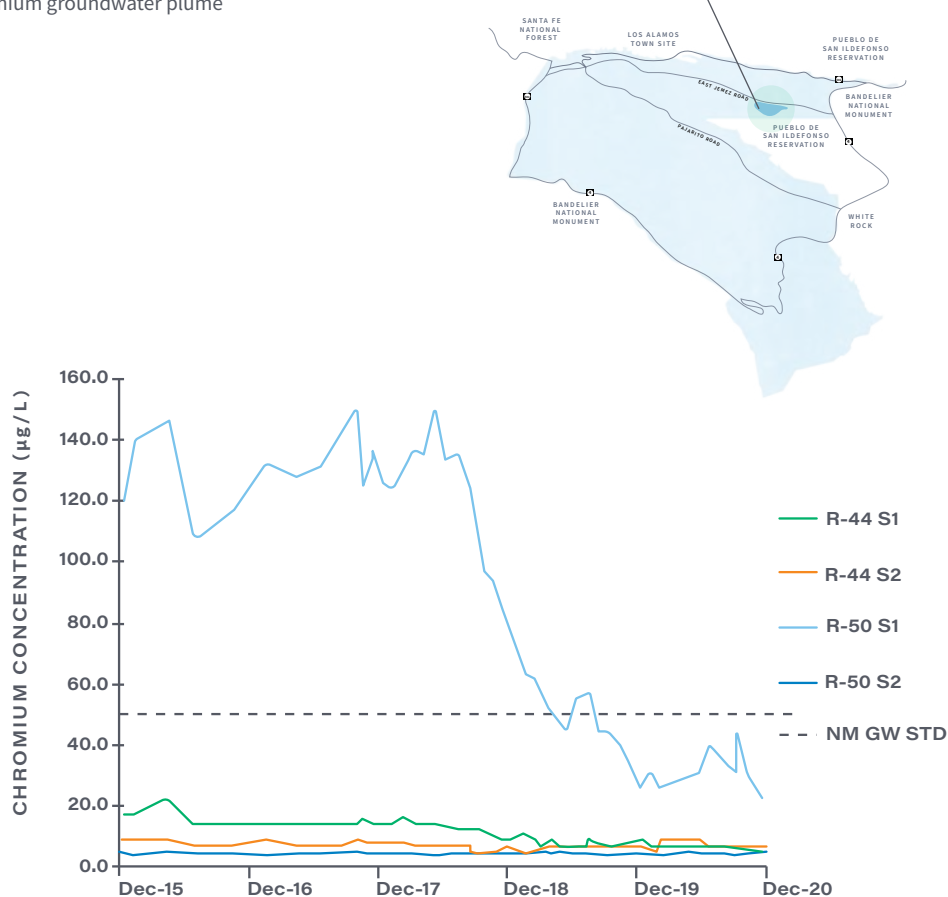




Locations of regional aquifer wells monitoring the chromium groundwater plume

In addition, wells located on the eastern portion of the plume, where operations began in late 2019, are also starting to show response to the interim measure.

Since discovering the chromium plume, the Laboratory has characterized and monitored the plume through installation of an extensive groundwater monitoring network and is continuing to conduct the Interim Measure to control plume migration. Monitoring wells in certain locations will continue to be used to track the effectiveness of these measures. Being able to track this information enables people in neighboring communities to understand the extent of chromium contamination in the groundwater, which helps them to make more informed decisions related to groundwater use.

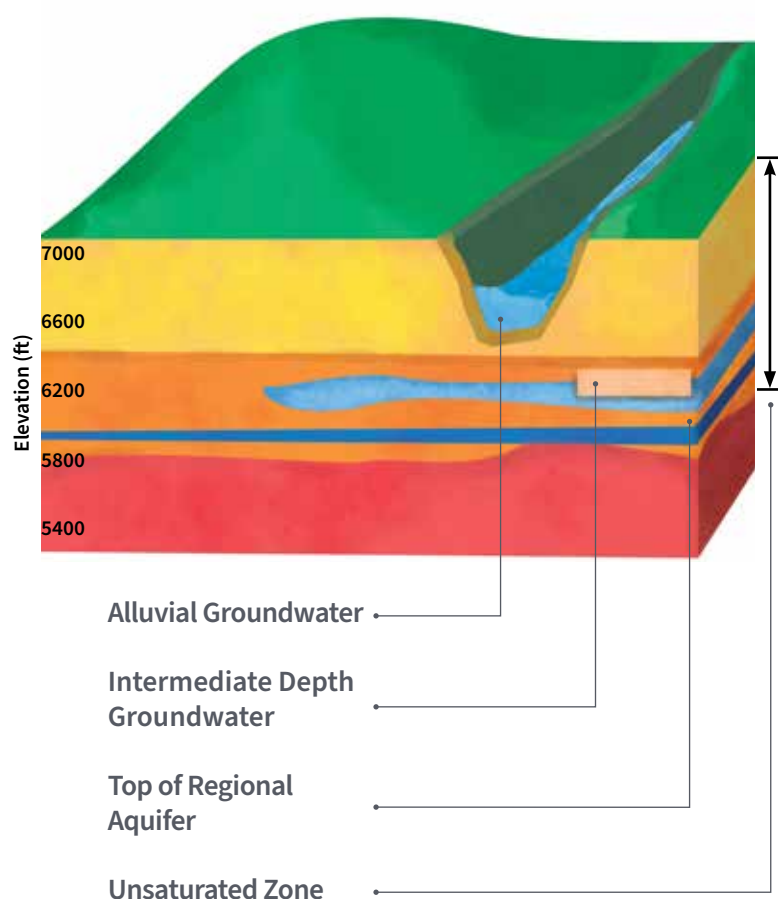


Monitoring the effectiveness of the Chromium Interim Measure

# Intellus Improvements and Groundwater Protection

The Laboratory and local environmental agencies continue to monitor groundwater and share results online.

Isabella Saeger



## Hydrogeologic Terms

**Saturated** rock or sediment is completely wet.  
**Unsaturated** rock or sediment has air in its pore spaces.

**Perched** groundwater is a zone of saturation of limited thickness that occurs above the regional aquifer.

**Alluvial** groundwater is a zone of saturation that exists in sands and gravels in the bottoms of canyons.

Historically, Los Alamos National Laboratory discharged contaminated water into surrounding canyons. Modern environmental regulations banned this earlier practice, and since the early 1990s, the Laboratory has significantly reduced both the number of industrial outfalls and the volume of water released. To ensure that the water table is not being affected by Laboratory activities, Laboratory staff test the surrounding groundwater each year to ensure the safety of both private and public drinking water systems.

“Groundwater monitoring has been completed at LANL for the past 75 years, starting shortly after LANL was established in 1943,” stated N3B/Tech2 Solutions Groundwater Monitoring Project Manager Zoe Duran.

“Over this time, the monitoring network has evolved to include 195 monitoring locations across the 40-square mile Laboratory campus.”

There are three types of groundwater beneath the Pajarito Plateau: alluvial groundwater in the bottom of some canyons, perched-intermediate groundwater, and the deep, laterally continuous regional aquifer. Sampling of these three groundwater sources occurs regularly to determine the fate and transport of known legacy waste



contaminants, to detect the arrival of potential contaminants in groundwater from previous releases, to evaluate efficacies of corrective action remedies, and to support proposed corrective measures.

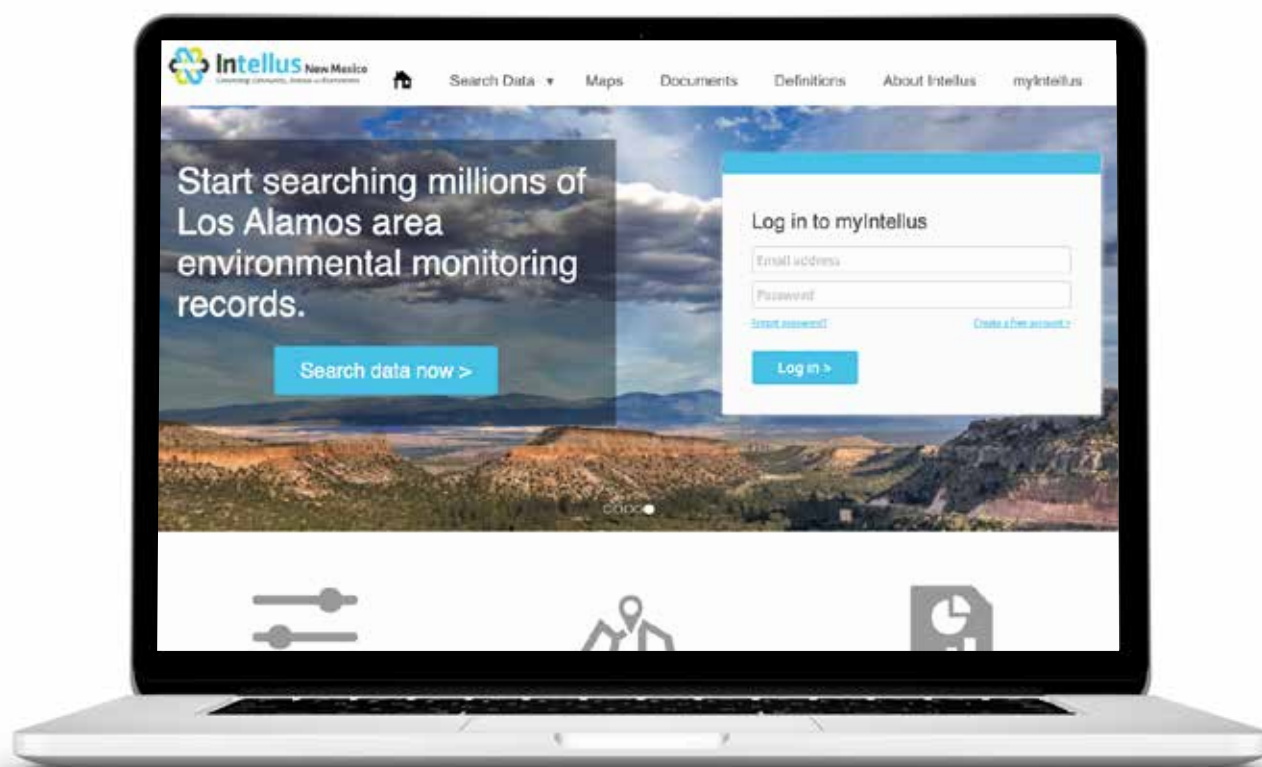
The same standards developed for drinking water systems are used as screening criteria for evaluating groundwater quality. The Department of Energy, the U.S. Environmental Protection Agency, and the New Mexico Water Quality Control Commission have set standards for contaminants in both groundwater and drinking water. Department of Energy Order 458.1 establishes dose limits for radiation exposure while the Safe Drinking Water Act establishes maximum contaminants levels in public water systems.

Water samples are collected from the operating water supply wells in the region surrounding Los Alamos. The Laboratory takes samples from 11 different water supply wells in Los Alamos County, four

water supply wells located on the Pueblo de San Ildefonso, and three water supply wells in the Buckman Well Field in Santa Fe. Additionally, sampling occurs at 195 monitoring locations throughout the Laboratory. No water supply wells showed detections of Laboratory-related constituents above applicable drinking water standards in 2020.

Intellus New Mexico, a database containing Los Alamos area environmental records, houses the analytical results collected as part of the water supply and monitoring well sampling for the Laboratory. This database has existed since 2012 and contains data collected by LANL and the New Mexico Environment Department. The main goal of Intellus New Mexico is to provide transparency of the results collected and analyzed by LANL and New Mexico Environment Department. The system is updated nightly and all data are verified before public release. This database contains over 16 million records, all of which are unclassified and publicly viewable.

The Intellus New Mexico database is available at [www.intellusnm.com](http://www.intellusnm.com). To begin a search of the database, click “Search data now” and use the quick search function provided. From here, millions of records are publicly available and can be accessed easily. A data provider can be selected, as well as data type, including analytical results, field measurements, groundwater levels, precipitation measurements. Further data qualifiers can be added, such as time period and location, and a specified output can be selected.



# 6

## CHAPTER 6.1 WATERSHED QUALITY

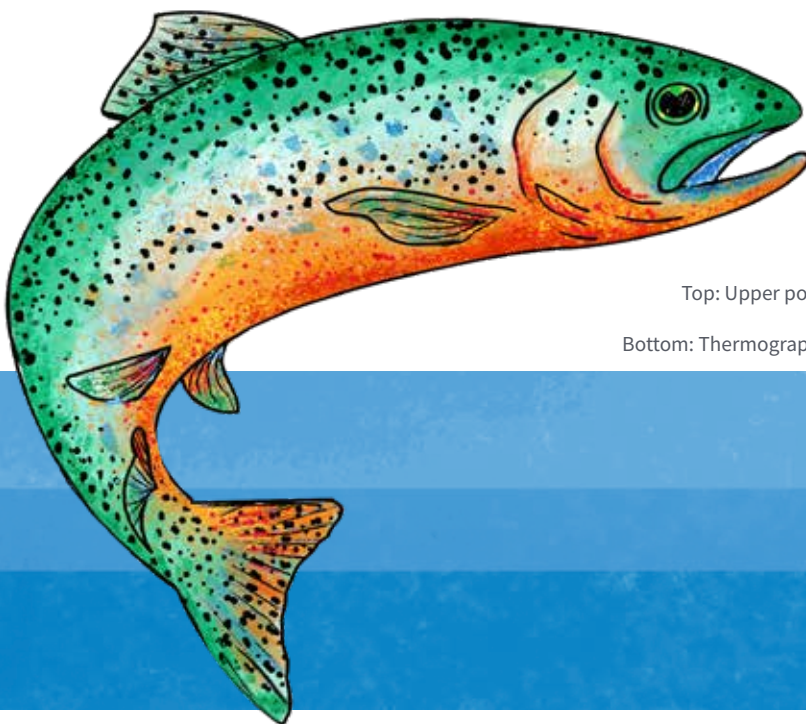
# Use Attainability Analysis for Upper Sandia Canyon

Use attainability analysis is helping to determine the feasibility of cold water aquatic life use in the Upper Sandia Canyon.

Jean Janvier

Because some of Los Alamos National Laboratory operations have the potential to affect the water quality of surrounding bodies of water, the Laboratory conducts routine tests on its property to ensure that it adheres to state standards, which are used to designate uses for water bodies. Many of these uses are based on the types of aquatic species that the water body is able to sustain healthily.

The state sets criteria to protect these uses, including those based on temperature, pH, and dissolved oxygen levels. If a particular criterion is unable to be met, then that water body is listed as impaired for that use. According to Robert Gallegos from the Environmental Compliance Program, "A designated use, which is not an existing use, may be removed if the state can demonstrate that attaining the designated use is not feasible due to naturally occurring contaminants or phenomena."



Top: Upper portion Sandia Canyon  
Grade structure

Bottom: Thermographs in Sandia Canyon





The following table shows a list of various designated uses as well as their temperature-based criteria:

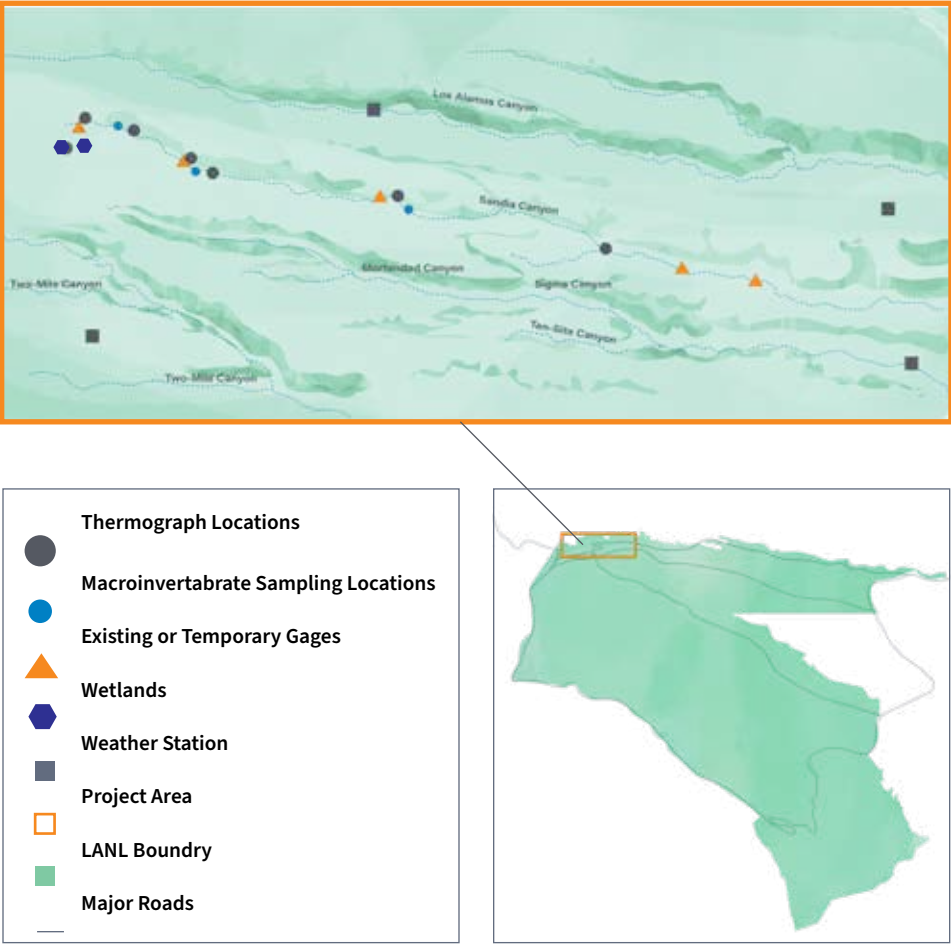
Temperature Criteria Definitions

Aquatic Life Uses	Maximum Temp. (°C)	6T3 (°C)
High-quality Coldwater	23	—
Coldwater	24	20
Marginal Coldwater	29	25
Cool Water	29	—
Warm Water	32.2	—
Marginal Warm Water	32.2	—
Limited	no default established	—

Maximum Water Temperature = water temperature not be exceeded anytime (°C)

6T3 = temperature not be exceeded for six or more consecutive hours in a 24-hour period on more than three consecutive days

Sandia Canyon Temperature Investigation



In 2020, a use attainability analysis was completed to determine if the Upper Sandia Canyon could meet the criteria for cold water aquatic life use. Upper Sandia Canyon is within Los Alamos National Laboratory boundaries. The water that flows into this canyon comes from effluent discharged from various outfalls across the Laboratory. In this study, various tools, including models and data collection processes, were used to determine whether or not the Upper Sandia Canyon can meet standards for cold water aquatic life use.

First, a model that applies the linear relationship between air temperature and water temperature to make predictions, also called an air-water temperature correlation model, was used. Air temperature data were collected from on-site monitoring stations and PRISM, a regression model, between July 2014 and July 2018.

By comparing the maximum water temperature and 6T3 to the temperature

criteria, the most attainable aquatic life use was determined. Overall, the data showed that cold water use is unattainable; however, warm water and marginal warm water uses could be consistently attained.

Water temperature data were also evaluated using thermographs used between 2014 and 2017 in the Upper Sandia Canyon and Sandia Crossing.

This data confirmed that while the canyon is not suitable for cold water use, cool water use can be attained in some locations during some years, and warm water use is attainable year-round.

Dissolved oxygen and pH data from three environmental surveillance gauges deployed between 2016 and 2019 were also evaluated. Data from

these gauges suggested that the canyon could be suitable for cold water use (see Figure 2), although the results mentioned above demonstrate that cold water use would still be unattainable.

Use attainability analyses are very useful because they provide information as to which uses are applicable to which water bodies. In this study, understanding that cold water use is unattainable due to water temperature exceedances may allow scientists to examine the possibility of changing the aquatic life use to something more feasible, thus allowing people in the surrounding communities to determine the optimal uses of their natural resources.

# Fish Monitoring in the Rio Grande and Abiquiu and Cochiti Reservoirs

**Aquatic health assessment determines that Laboratory operations represent no harm to local fish populations' health.**

Ashlyn T. Lovato

The purpose of fish monitoring is to detect if Laboratory operations affect the health of the nearby aquatic ecosystem. To test this, researchers take samples of both carnivorous fish and bottom-feeding fish that are captured with nets or rod and reel and then euthanized using methods approved by the LANL Animal Care and Use Committee.

In 2020, a total of 37 fish samples were taken from Abiquiu Reservoir (north and upstream of the Laboratory), Cochiti Reservoir (to the south and downstream), and from upstream and downstream portions of the Rio Grande (located downhill and to the east of the Laboratory).

The fish were sent to analytical labs in Colorado, South Carolina, and North Carolina. One side of the fish was then analyzed for inorganic elements, (some naturally occurring) and can include salts and metals such as gold, silver, and copper. The other side of the fish was tested for polychlorinated biphenyls (PCBs) and polyfluoroalkyl substances (PFAS), man-made chemicals that can be harmful at high concentrations. The remaining body of the fish was tested for radionuclides, which are atoms with excess energy emitted as ionizing radiation that can damage living cells.



Laboratory staff on the boat monitoring fish.

**Overall, the amounts of inorganic compounds, radionuclides, PCBs, and PFAS found in fish at all four locations were consistent with previous years or continue to decrease in some locations, and all together represent no harm to the health of local fish populations.**

## Rio Grande Results

Based on the 2020 results in the Rio Grande locations, two naturally occurring radionuclides, uranium-234 and uranium-238, were detected in all fish. Uranium naturally occurs in rocks, so detection in all four locations is normal and not from Laboratory activities.

Radium-226 was also detected at 0.50 picocuries per gram, which is slightly above the regional statistical reference level of 0.49 picocuries per gram. All other radionuclides were below the regional statistical reference level (the upper limit of radionuclides that are detected in the environment) and below the biota dose screening level (the level of which is protective of plants and animals).



In the Rio Grande, one fish showed traces of an inorganic element—magnesium—that was above the regional statistical reference level. But because magnesium is an essential element, it is of no health concern to the fish population.

Arsenic was increasing but consistent between upstream and downstream locations, meaning that the Laboratory is not contributing significantly to these levels. Mercury was also found in all fish, although the levels have remained consistent between upstream and downstream locations, and no Rio Grande fish exceeded U.S. Environmental Protection Agency (EPA) human consumption limits.

PCB concentrations were higher in bottom-dwelling fish, although all concentrations were below the EPA human consumption screening value of 12,000 picograms per gram and were below the values associated with adverse effects on fish growth and reproduction. All locations on the Rio Grande returned similar results for PFAS chemicals, which have only recently become a concern, and New Mexico does not yet regulate the chemicals.

“As PFAS are recently emerging chemicals of concern, little is known about wildlife tissue concentrations and their relation to adverse effects,” says Shannon Gaukler, who is a program lead of the Soil, Foodstuffs and Biota program.

## Abiquiu and Cochiti Reservoir Results

For the 2020 radionuclide results within the Abiquiu and Cochiti reservoirs, one fish from Cochiti reservoir slightly exceeded the regional statistical reference level for radium-228, which naturally occurs in rocks, soil, water, and plants.

Some fish also showed levels of strontium-90, a fallout radioactive material from nuclear weapons testing. But the detected levels were similar in both reservoirs, meaning Laboratory operations are not contributing, and these levels have been decreasing over time.

For inorganic elements, mercury was detected in all fish from both reservoirs. Two bottom-feeding fish from the Abiquiu Reservoir exceeded the EPA’s human health consumption screening value of 0.3 milligrams per kilogram, although mercury levels in both reservoirs have been decreasing from past levels.

Aluminum and magnesium concentrations were higher in fish collected at the Abiquiu Reservoir, while copper concentrations were higher in the Cochiti Reservoir. All concentrations were below regional statistical reference levels, which are used to establish comparisons to areas beyond Laboratory influence.

Three fish collected from the Cochiti Reservoir exceeded the regional reference level for total PCB concentration of 5,647 picograms per gram. However, no fish exceeded the EPA’s human health consumption screening value of 12,000 picograms per gram.

Overall, the public should not be concerned that Laboratory operations are impacting fish or aquatic ecosystem health or those who consume local fish.



Top: Rio Grande; Bottom: Cochiti Reservoir

# Bird Eggs and Nestling Results from Firing Sites

Los Alamos National Laboratory monitors the health of local bird populations by placing avian boxes that help monitor nest success.

Makenzie L. Quintana



Each year, the Laboratory tests for radionuclides and chemicals in nonviable bird eggs and nestlings that died of natural causes at sites used for explosives testing, most commonly called “firing sites.” Both inorganic elements (mostly metals) and organic compounds (chemicals containing a carbon-hydrogen bond, such as polychlorinated biphenyls [PCBs]) can present health risks to birds if exposed at high concentrations. The Laboratory focuses on organic and inorganic elements, as well as radionuclides when monitoring the environment.

At the Laboratory, sources of inorganic elements—like beryllium, selenium, and zinc—can be released from human activities at firing sites or from natural geological sources. Birds are exposed to these elements in numerous ways, such as ingestion of soil, food, water, and inhalation.

“Nest boxes are placed around firing sites and are then compared with control sites,” says Audrey Sanchez, an environmental professional and wildlife biologist at the Laboratory. “These comparisons allow us to evaluate any potential impacts to species from Laboratory operations at the firing sites.”

Western Bluebird



The nest boxes were placed 20 to 30 meters from each other at three sites—Minie at Technical Area 36 (TA-36), Point 6 at Technical Area 39, and the burn grounds at Technical Area 16. In 2020, six nonviable eggs, which are eggs that are unlikely to develop hatchlings, were collected on Laboratory property. Eighteen nonviable eggs were collected from background locations, off-site areas used to compare findings, such as Bandelier National Monument.

“When we check nest boxes, there are times when eggs do not hatch or nestlings do not make it for a variety of reasons,” says Elisa Abeyta, a post-bachelor student who worked on the project. “Nonviable eggs are cold to the touch and are no longer being incubated by its parent, or will not hatch when the other eggs in a nest have hatched. We collect nonviable eggs or dead nestlings from their nest, put them in a small jar, and label them with the location, date, and species of bird.”

Chemical concentrations were evaluated in two western bluebird nestlings that died naturally and six nonviable western bluebird eggs, which were collected from seven avian nest boxes at Technical Areas 36, 16, and 39. Nonviable eggs were only evaluated for inorganic elements due to the limited samples collected.

The results were compared with regional statistical reference levels, as well as TCDD toxic equivalent values. TCDD is a dioxin, and one of the sources that generates it is wildland fires, but researchers also look for traces of this chemical around firing sites.

The bird eggs collected from Technical Area 16 (five samples) and Technical Area 36 (one sample) showed either no detectable levels or were below the regional statistical reference levels for inorganic elements. The overall results indicate that the levels of inorganic elements in the eggs collected from these firing sites are not likely to cause adverse effects in the bird populations.



Ash throated Flycatcher (above)  
Nestbox on lab property (right)



The results of the chemical concentrations found in bird nestlings showed that most dioxins and furans were not detected in the nestling samples that had been collected from Technical Area 39 and Technical Area 16. The detection patterns and concentrations of inorganic elements between the nestling from Technical Area 16 and a sample from a background location were found to be similar, meaning Laboratory operations are likely not a contributor.

Due to the lack of samples, there were no regional statistical reference levels available for some comparisons. So additional background samples need to be analyzed to allow for relevant comparisons.

Overall, many chemicals were not detected, and those that were showed levels below the regional statistical reference levels, observable adverse effects levels, and toxic equivalents.

**Therefore, researchers determined that the detectable concentrations produced by the Laboratory are not of current ecological concern.**

## TA-16 Burning Grounds Avian Research Site



**LEGEND**

- Avian Nest Boxes
- - - Avian Point Count Transect
- \* Site
- Major Roads
- LANL Boundary

# 8

## CHAPTER 8.1 RADIOLOGICAL DOSE AND NONRADIOLOGICAL RISK TO THE PUBLIC

# Monitoring Radiation Emissions

The Laboratory constantly monitors radiation levels from its operations both on and off Laboratory property to ensure these levels are safe.

Carina Echave

### Radiation Overview

Each year, the Los Alamos National Laboratory monitors the dose of ionizing radiation that members of the public could receive from its operations. Ionizing radiation can damage living cells by ionizing cell molecules, and a dose is a measure of the amount of damage caused, calculated in units of millirem.

So how does the Laboratory monitor ionizing radiation?

First, it is important to know the pathways that can expose people to ionizing radiation (often referred to simply as “radiation”). These pathways include penetrating radiation, ingesting food and water containing radioactive material, and inhaling particles containing radioactive material. Radiation that could cause exposure is calculated for each pathway in order to determine the dose to members of the public around the Laboratory.

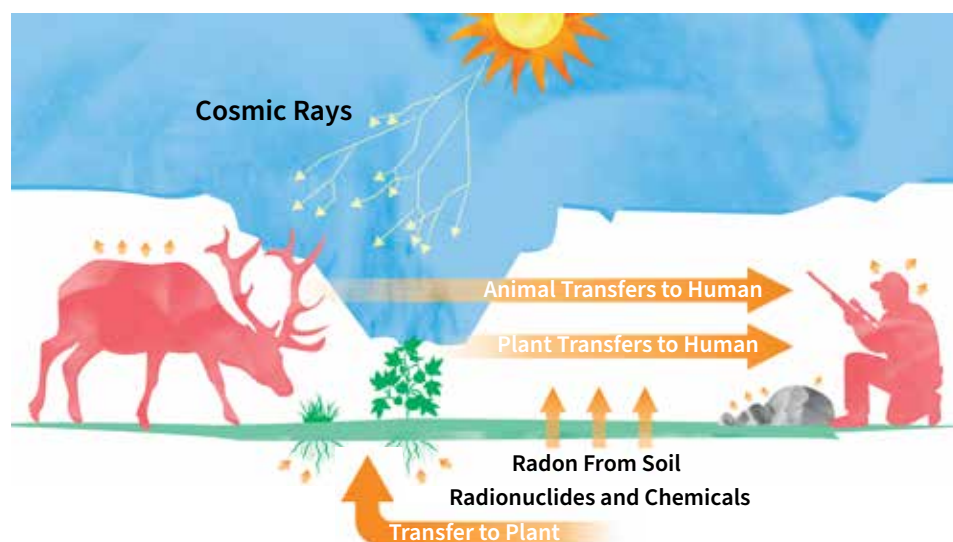
### Maximally Exposed Individual

The maximally exposed individual (MEI) is a hypothetical member of the public who would receive the highest possible radiation dose from the Laboratory in a year. This person is assumed to stay for the entire year at the location with the highest radiation dose from the Laboratory, eating locally grown crops and drinking Los Alamos County water. The importance of this hypothetical person for radiation monitoring is that all real members of the public are exposed to smaller radiation doses from the Laboratory. Therefore, if the MEI’s exposure to Laboratory radiation is safely below all health regulations, then the same

is true for every member of the public living in surrounding areas.

To find the MEI location, Laboratory health physicists consider publicly accessible places on and off Laboratory property. The locations with the highest total dose from all radiation exposure pathways are reported as the onsite and offsite MEI locations that year.

“Safety regulations are set far below the levels at which health effects are observed, so if the doses are below safety regulations, the health effects, if any, are too small to measure,” says Michael McNaughton, a Laboratory health physicist. “For example, health effects are observed for doses of 10,000 millirem, so the DOE limit is set at 100 millirem per year.”





## Offsite MEI

In 2020, the offsite MEI location was at 132 DP Road, close to environmental air-monitoring station 326. Doses to the MEI from direct penetrating radiation and ingestion of food and water were too small to measure, while the dose from inhalation of radioactive material was 0.29 millirem. This means that the total offsite MEI dose from Laboratory operations was 0.29 millirem.

## Onsite MEI

In 2020, the MEI location on Laboratory property was at East Jemez Road near Technical Area 53. The dose to the MEI from direct penetrating radiation was 0.7 millirem, while doses from inhalation and ingestion of food and water were too small to measure. According to guidance from the National Council on Radiation Protection and Measurements, members of the public spend less than 1/40 of their time at this location. Using this correction, the total onsite MEI dose was less than 0.02 millirem.

## MEI Doses are Below Safety Regulations

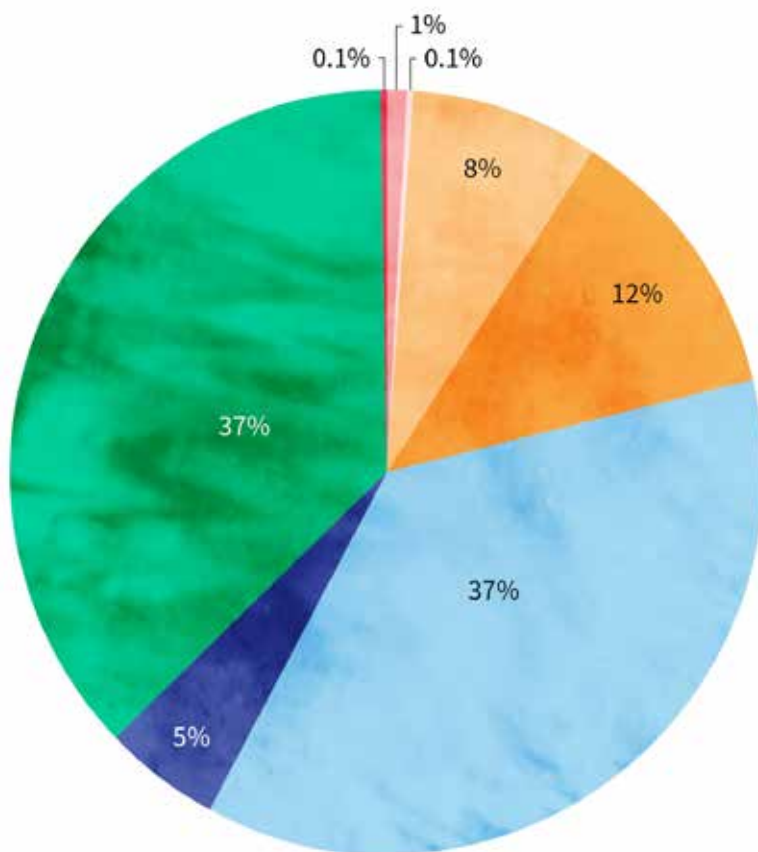
To determine if the MEI dose is safe, there are two important regulations to consider. First, the Department of Energy has set a safety limit of 100 millirem for the total dose to each member of the public from Laboratory operations. Second, the Environmental Protection Agency requires that the dose to each member of the public from airborne radioactive material be less than 10 millirem per year.

At both the offsite and onsite MEI locations, the dose was far below the 100 millirem total dose and 10 millirem airborne dose limits set by these regulations.

**At both the offsite and onsite MEI locations, the dose was far below the 100 millirem total dose and 10 millirem airborne dose limits set by DOE and EPA.**



Offsite MEI location



### Man-made sources:

- Man-made products
- Nuclear fallout
- Laboratory pathways
- Medical/Dental

### Naturally occurring sources:

- Terrestrial radiation
- Radon
- Potassium-40
- Cosmic radiation

Sources of annual radiation exposure. Most (62%) is from background sources; less than 0.1% is from Laboratory pathways. (Values greater than 1% were rounded.)

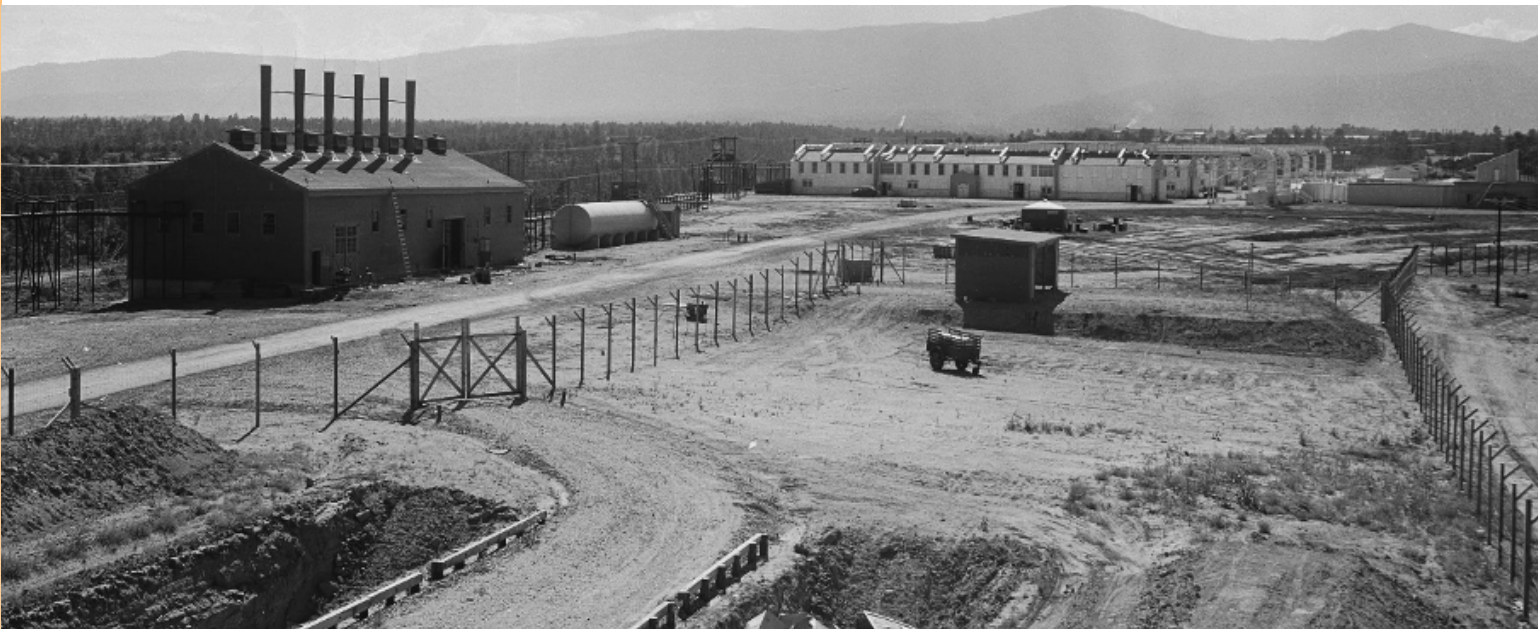
# 8

## CHAPTER 8.2

# Buried Waste along DP Road

The contamination found in 2020 along DP Road was discovered on three adjacent land parcels.

Carina Echave



Waste disposal at Material Disposal Site A around late 1945. Similar waste disposal is expected to have occurred nearby at the Middle DP Road site during this same time period.

In February, May, and June 2020, radioactive waste was found at sites being excavated along DP Road, located on DP Mesa just south of the Los Alamos County Airport. The Department of Energy had previously conveyed this land to Los Alamos County after it was surveyed and approved as clean and meeting standards for land conveyance.

Why, then, was radioactive waste, including plutonium and uranium, unexpectedly found on DP Mesa?

Records and interviews indicate that during the Manhattan Project, solid radioactive waste was put in disposal pits on DP Mesa. However, these pits were not closely managed, and the number and location of the pits were not well documented. This means that surveyors had to come in later and take surface and borehole samples to determine where waste had been buried.

Surface sampling was done along DP Road prior to conveyance. However, backhoe sampling that might have been able to detect buried waste was not

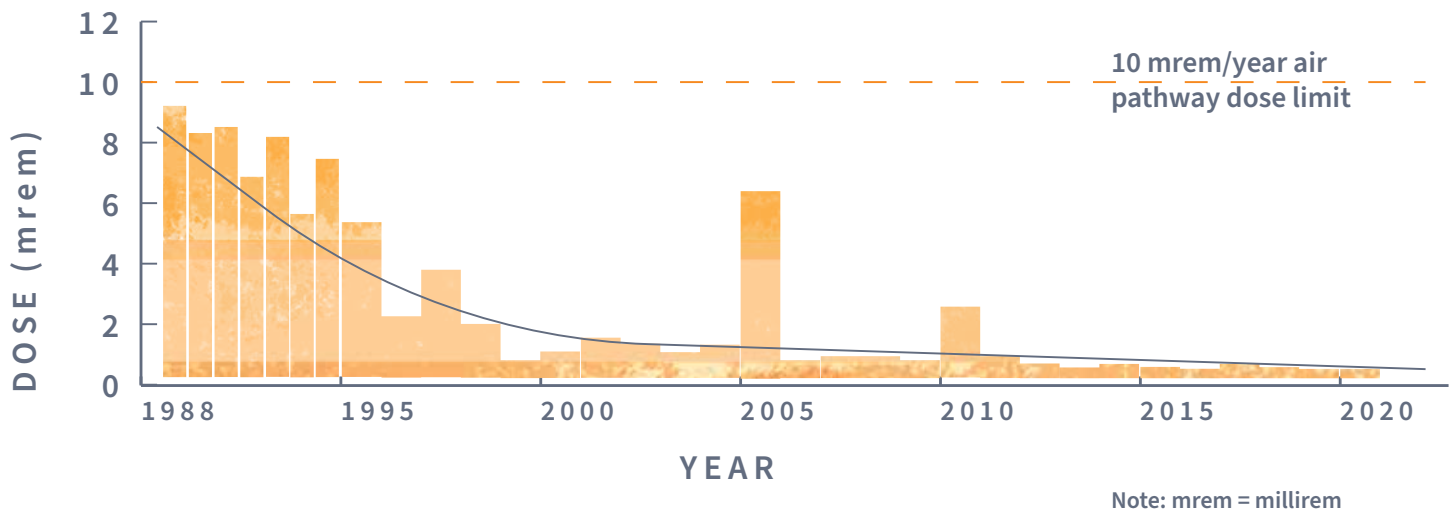
conducted because no records indicated buried waste was present at the location.

At the current stage of excavation at the Middle DP Road site, Michael McNaughton, a Laboratory health physicist, says there is “no measurable hazard from the waste because the area is restricted from public access and the waste is kept covered, and the air pathway is continuously monitored.”

By the air pathway, McNaughton refers to any airborne radioactive particles that might be inhaled. Air monitors set up around the area are checked regularly to see if the filters contain any radioactive particles.



## Annual Maximally Exposed Individual Dose



View of Middle DP Road excavation site in 2020.

In determining potential health risk from the waste, an important question addressed was whether the waste contributed an unsafe dose to the maximally exposed individual (MEI). The MEI is a hypothetical person who would receive the highest possible radiation dose from Laboratory operations.

In 2020, the MEI location was at 132 DP Road, which is close to the Middle DP Road excavation area. Because the radioactive material at Middle DP Road was mostly stuck to glass shards and other waste, it is unlikely that it became airborne and contributed to the MEI

inhalation dose. Rather, surface soil all over the DP Road site contains small amounts of radioactive material, and so construction on DP Road in 2020 kicked up dust with radioactive material in it. This dust was a major contributor to the airborne MEI dose.

It is important to note that no matter the source of airborne radioactive material on DP Road, the 2020 MEI dose was 0.29 millirem. This is well below the required 10 millirem per year limit set by the Environmental Protection Agency, which outlines this limit in its “National Emission Standards for

Hazardous Air Pollutants Other Than Radon From Department of Energy Facilities” regulations.

**This means that although investigators originally missed waste dating to the early 1940s with plutonium and uranium in it on DP Road, the waste is not contributing an unsafe dose to members of the public.**

# Contributors



**Aaliya M. Casados**

EPC-ES, Cultural Resources

Hometown: Chimayo, NM

Education: New Mexico Highlands University, Masters of Arts in Curriculum and Instruction

This year, I learned the importance of protecting archaeological sites to minimize deterioration caused by people and the environment. By prioritizing preservation at the Laboratory, historical and ancestral sites can remain as glimpses into the lives of those who came before us, which encourages local children to be aware of the culturally rich surrounding areas that we call home.



**Abdul Khweis**

EPC-ES, Pollution Prevention

Hometown: Taos, NM

Education: Columbia University, Environmental Science with a minor in Business

I'm proud to have worked with the Lab to improve our community and its environment for years to come. I have gained outstanding work experience before entering college, and I plan to build on this momentum in my career and beyond. After graduating, I hope to return to my hometown, Taos, and use my knowledge to advance more environmental initiatives.



**Ashlyn T. Lovato**

EPC-ES, Cultural Resources

Hometown: Santa Clara Pueblo, NM

Education: Brown University, Linguistic Anthropology

Before working at the Laboratory this summer, I was unaware of a Cultural Resources team and the crucial role it plays in day-to-day operations. By working with this team, I was able to incorporate my knowledge and research on Indigenous languages and land connection in my work at the Lab. Many Pueblos have ties to sacred spaces that are currently occupied by the Laboratory or the town of Los Alamos. The work done through the Cultural Resources team ensures some protection of these ancestral sites.



**Beatrice Nisoli**

EPC-ES, National Environmental Policy Act

Hometown: Los Alamos, NM

Education: University of New Mexico, dual degrees in Pure Mathematics, Philosophy, and French

In working on a powerline environmental assessment, I was tasked with evaluating the impacts of a proposed project on greenhouse gas emissions at the Laboratory. I became more acquainted with the Laboratory's emission rate, equipment, and projects that can have a potentially

drastic effect on this rate, and, most importantly, how the Laboratory has been working to decrease its emissions steadily since 2008. My work with NEPA involved collaboration with environmental lawyers, experience that I will take forward as I pursue a law degree.



**Caitlyn Cruz**

EPC-ES, Cultural Resources and Chemical Management

Hometown: Ohkay Owingeh, NM

Education: New Mexico State University, Environmental Science/Chemistry

The most important thing I learned at the Lab this year was the programs and operations that the Pollution Prevention team runs to ensure the environmental safety and compliance of Lab operations. I can apply this to my education and career by conducting research that dives into the effectiveness of these operations, possibly identifying alternative or more efficient approaches. Work at the Lab connects to life in my hometown by expanding my knowledge and experience in career fields that I could use to give back to my community.



**Carina Echave**

EPC-ES, Health Physics

Hometown: Los Alamos, NM

Education: University of New Mexico, Bachelor of Science in Chemistry

This year, I had an opportunity to work on my programming skills, which will become a valuable experience since it can be used in chemistry, as well as



other scientific fields I may choose to work in. My parents care greatly for the environment, and they taught me to do the same growing up. To me, working in Environmental Protection is an extension of that—doing so means putting my knowledge to use in continuing to care about the environment.



### **Isabella Saeger**

**EPC-ES, Pollution Prevention**  
**Hometown: Los Alamos, NM**  
**Education: University of New Mexico, Bachelor of Science in Psychology**

My time working for Pollution Prevention has taught me how to be realistic, but also optimistic, about environmental conservation.



### **Jean Janvier**

**EPC-ES, Pollution Prevention**  
**Hometown: Alexandria, VA**  
**Education: Johns Hopkins University, Master of Health Science in Environmental Health**

The most important thing that I have learned at the Lab is how various communities in New Mexico preserve and value their natural resources, especially their water resources. People here really take pride in preserving their environment. This experience will allow me to learn how to interface with people in various communities and learn about how to get others engaged in taking care of their environment. Because my family is from Haiti, I am able to connect how people here in New Mexico and in Haiti rely on the land and its natural resources to survive.



### **Makenzie L. Quintana**

**EPC-ES, Biological Resources**  
**Hometown: Pojoaque, NM**  
**Education: New Mexico State University, Wildlife Biology and Conservation Ecology**

Because I grew up near the Lab, most of the wildlife I spent my time studying can also be found near my own home. I have always had a love for animals, but this job has increased my understanding of their importance in the environment. In particular this year, I have also learned a lot about the plants in the surrounding area. Wildlife biology is not all about the animals—it includes the different plant species that sustain life as well.



### **Mariah Gonzales**

**EPC-ES, Cultural Resources**  
**Hometown: Española, NM**  
**Education: Northern Arizona University, Bachelor of Arts in English and Political Science**

The experiences I have had this summer have exposed me to a new career field in archaeological history, which gave me skills in documenting sites and engaging myself in the history of New Mexico. This has helped me understand the communities around me and has given me an appreciation for the diverse cultural groups I interact with.



### **Victoria Lovato**

**EPC-ES, Cultural Resources**  
**Hometown: Ojo Caliente, NM**  
**Education: University of New Mexico, School of Law**

In the face of an unprecedented year, adversity fostered innovation on my team, and we were able to meet the difficulties with new ideas and restoration of components of the Manhattan Project National Historical Park. My experience at the Lab has helped my writing and researching skills, and when I return to school, I will be a writing tutor for the spring semester, an opportunity that I attribute to the experience I gained at the Lab while drafting and authoring compliance documentation for historic buildings.

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